ORIGINAL ARTICLE

Prevalence and risk factors of intestinal parasitic infections in a tertiary care teaching hospital

Zarine Khan[1], Tarana Sarwat[1], Riti Srivastava[1], Dalip K. Kakru[1]*

[1]Department of Microbiology, School of Medical Sciences and Research, Sharda Hospital, Greater Noida-201306 (Uttar Pradesh) India

Abstract

Background: Infections due to intestinal parasites are a major public health concern in developing countries contributing to morbidity as well as mortality in the population. *Aim and Objectives:* A hospital-based cross-sectional study was done to determine the prevalence of intestinal parasites and association with different risk factors. *Results:* The total prevalence was found to be 15%, with protozoans being more common (63%) than helminths (33%). Cyst of *Entamoeba histolytica/dispar* was the most common protozoan and *Ascaris* was the most common helminth isolated. Rural residence, open defecation and barefoot walking were significantly associated ($p < 0.05$) with the prevalence. *Conclusion:* Along with mass deworming and elimination program being carried out by the government, results of this study would help in planning and implementing specific policies in the area.

Keywords: Intestinal Parasitic Infections, Soil Transmitted Helminths, Ascaris, Hookworm

Introduction

Intestinal Parasitic Infections (IPIs) pose a significant global health problem causing morbidity and mortality in the affected population [1]. IPIs have high prevalence in developing countries and are being recognised as neglected tropical diseases [2-3]. WHO estimates about 1.5 billion people or 24% of the world population to be infected with intestinal parasites, especially Soil Transmitted Helminths (STH) [2]. Increasing population, inaccessibility to clean drinking water, contaminated food, poor and inadequate sanitation facilities, walking or working barefoot on contaminated soil, are few of the causes for the IPIs to be prevalent in developing countries [5-6]. The common presenting complaints range from fever, anorexia, malaise, vomiting, abdominal discomfort, diarrhoea and dysentery. Often, complications like anaemia, iron and Vitamin A deficiency, growth retardation, poor educational performance and other physical and mental consequences are especially seen in children, attributed to IPIs [5, 7]. Even though the community-based public health studies are more useful in providing IPI data, the hospitals also act as sentinel centres giving an insight into the parasitic burden and morbidity caused by them. It also helps in developing focused prevention programmes against these intestinal parasites [1]. This cross-sectional study was performed to know the prevalence of intestinal parasites, to determine various demographic factors associated and to compare the concentration technique of stool examination with the routine microscopy. No such prevalence study has earlier been conducted in the region (area around Greater Noida, a city in the state of Uttar Pradesh, India) to the best of our knowledge. The findings would potentially help in drafting and implementing prevention policies in this locality.

Material and Methods

This cross-sectional study was conducted in the Department of Microbiology, SMS&R, Sharda Hospital, Greater Noida from January 2022 to February 2023. All samples received in the Parasitology division of Central Laboratory during this period were included. Unlabelled, leaking and duplicate samples were excluded. The demographic details and the clinical features were obtained from the medical records. The samples were examined macroscopically for consistency, colour and presence of pus, mucus, blood and any worm segments or adult worm. Wet mount with normal saline and iodine of all the stool samples were prepared and examined microscopically under low- and high-power magnification. Simultaneously, all the stool samples were subjected to concentration by formol ether technique as per standard procedure and examined microscopically [8]. Modified Ziehl Nelson with 1% sulphuric acid, was done only in those samples which were suspected to have oocyst of *Cryptosporidium sp.* and *Cystoisospora sp.* on wet mount examination as the patients were immunocompromised.

Statistical analysis

Data was entered in MS Excel and analyzed using IBM SPSS Statistics for Windows Version 25. Prevalence was calculated using descriptive statistics. Chi-square (χ^2) test was applied to check the statistical association between intestinal parasitosis with the clinical and demographic factors. The value of $p < 0.05$ was considered significant. Compared to microscopy, the sensitivity and specificity of the concentration technique were also calculated.

Results

Demographic factors

Table 1 describes the demographic details of the sample population. A total of 517 samples were received. Out of them, 333 (64%) were males and 184 (36%) were females. The patients' age ranged from less than a year to 85 years and were grouped into four age categories i.e. ≤ 20, 21-40, 41-60 and > 60. Maximum samples were seen in the category 21-40 years (197, 38%) followed by ≤ 20 years 187 (36%), 41-60 years 93 (18%) and least in > 60 years 40 (8%).Most of the samples received were from urban population 345 (67%). Among the samples received from rural population 172 (33%), open defecation and barefoot walking was seen in 50 (10%) and 16 (3%) respectively. Open defecation and barefoot walking were absent in urban population.

Out of the total 517 samples, 79 (15%) samples showed positive findings, mostly from rural areas 54 (31%) which was significantly associated ($p < 0.05$). Positive findings were also significantly associated with open defecation and barefoot walking ($p < 0.05$). Positive findings were seen more in samples received from male patients 56 (17%) compared to female patients 23 (13%). The age group category 21-40 years showed the maximum positive findings 34 (17%) and least was seen in the age category > 60 years 1 (3%). Positive findings were not statistically associated with age and gender ($p > 0.05$). In terms of clinical features, the most common feature in the positive samples was dysentery (55.2%) followed by fever (52.5%), as shown in Table 2.

Table 1: Socio-demographic information of study population (n=517)

Feature	Category	Number (Percentage)
Age group	⩽ 20	187 (36%)
	21−40	197 (38%)
	41−60	93 (18%)
	> 60	40 (8%)
Sex	Male	333 (64%)
	Female	184 (36%)
Residence	Rural	172 (33%)
	Urban	345 (67%)
Sanitation	Open	50 (10%)
	Closed	467 (90%)
Barefoot	Yes	16 (3%)
	No	501 (97%)

Table 2: Association of major clinical features in samples with positive findings

Clinical features	Number	Positive (%)	Negative (%)	*p*
Fever	40	21 (52.5)	19 (47.5)	0.00001
Abdominal pain	137	65 (47.5)	72 (52.5)	0.00001
Dysentery	29	16 (55.2)	13 (44.8)	0.00001
Diarrhoea	145	65 (44.8)	80 (55.2)	0.00001

Prevalence of intestinal parasites

The prevalence of intestinal parasitosis was found to be 15% (79/517) in the sample population. Prevalence of infection due to protozoans were higher compared to helminths, 63% and 33% respectively. The prevalence of different parasites is shown in Figure 1. Among the protozoans, cyst of *Giardia lamblia* 31 (39%) was most commonly seen followed by *Entamoeba histolytica/dispar* 13 (17%), oocyst of *Cystoisospora belli* 4 (5%) and oocyst of *Cryptosporidium parvum* 2 (3%). Modified acid fast staining was performed only in 6 of the samples. Among the helminths egg of *Ascaris* was the most common 15 (19%) followed by that of hookworm 7 (9%), *Trichuristrichiura* 3 (4%) and *Hymenolepsis nana* 1 (1.3%).

Monoparasitism was seen in 76 (96.2%) cases and bi-parasitism was seen in 3 (3.8%)cases. Multiple parasitism was absent in this population. Table 3 summarizes the prevalence of each parasite based on risk factors and gender. Statistically significant association ($p < 0.05$) was seen with barefoot and the prevalence of soil transmitted helminths as shown in Table 4. Table 5 highlights the risk factors and prevalence values for the pediatric subgroup (0-12 years) of the ≤ 20 years age group. The prevalence is a little higher (19%) in the pediatric subgroup as compared to 17% in the ≤ 20 years age group.

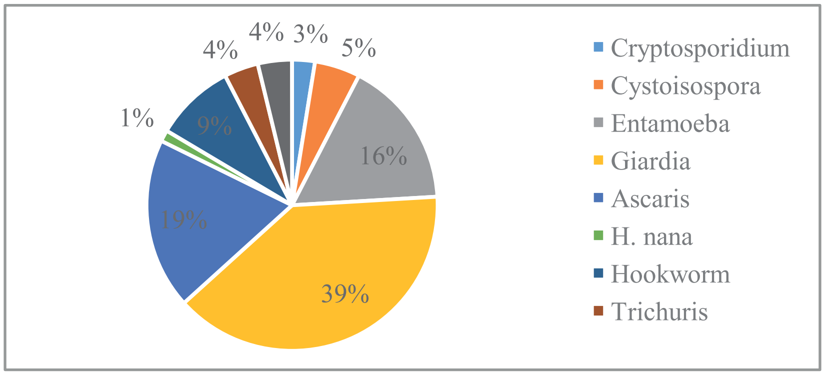

Figure 1: Prevalence of different parasites (Positive: 79)

Table 3: Prevalence of different parasites for different risk factors and gender

Category →	**Overall**	**Residence**		**Defecation**		**Barefoot**		**Gender**	
		Rural	**Urban**	**Open**	**Closed**	**Yes**	**No**	**Male**	**Female**
Positive cases	79	54	25	30	49	16	63	56	23
Cryptosporidium	2.5%	3.7%	0.0%	0.0%	4.1%	0.0%	3.2%	1.8%	4.3%
Cystoisospora	5.1%	5.6%	4.0%	6.7%	4.1%	0.0%	6.3%	3.6%	8.7%
Entamoeba	16.5%	14.8%	20.0%	10.0%	20.4%	0.0%	20.6%	14.3%	21.7%
Giardia	39.2%	27.8%	64.0%	23.3%	49.0%	6.3%	47.6%	42.9%	30.4%
Ascaris	19.0%	25.9%	4.0%	40.0%	6.1%	50.0%	11.1%	19.6%	17.4%
H. nana	1.3%	1.9%	0.0%	0.0%	2.0%	0.0%	1.6%	1.8%	0.0%
Hookworms	8.9%	13.0%	0.0%	13.3%	6.1%	37.5%	1.6%	10.7%	4.3%
Trichuris	3.8%	3.7%	4.0%	3.3%	4.1%	0.0%	4.8%	1.8%	8.7%
Mixed	3.8%	3.7%	4.0%	3.3%	4.1%	6.3%	3.2%	3.6%	4.3%

Statistically significant association ($p < 0.05$) was seen with barefoot and the prevalence of soil transmitted helminths as shown in Table 4. Table 5 highlights the risk factors and prevalence values for the pediatric subgroup (0-12 years) of the ≤ 20 years age group. The prevalence is a little higher (19%) in the pediatric subgroup as compared to 17% in the ≤ 20 years age group.

Table 4: Association of infections with risk factors

Risk factor	Category	Total (n=517)	Positive cases (n=79)	Negative cases (n = 438)	χ^2	*p*
Age group	**⩽ 20**	187	31 (17%)	156 (83%)	6.0074	0.111
	21−40	197	34 (17%)	163 (83%)		
	41−60	93	13 (14%)	80 (86%)		
	> 60	40	1 (3%)	39 (98%)		
Sex	**Male**	333	56 (17%)	277 (83%)	1.7060	0.191
	Female	184	23 (13%)	161 (88%)		
Residence	**Rural**	172	54 (31%)	118 (69%)	51.7052	0.0001
	Urban	345	25 (7%)	320 (93%)		
Sanitation	**Open**	50	30 (60%)	20 (40%)	85.5102	0.0001
	Closed	467	49 (10%)	418 (90%)		
Barefoot	**Yes**	16	16 (100%)	0 (0%)	91.5419	0.0001
	No	501	63 (13%)	438 (87%)		

Table 5: Risk factors for age group 0-12 years with total 131 and 25 (19%) positive cases

Risk factor	Category	Total	Positive cases	Negative cases
Sex	Male	98	21 (21%)	77 (79%)
	Female	33	4 (12%)	29 (88%)
Residence	Rural	48	21 (44%)	27 (56%)
	Urban	83	4 (5%)	79 (95%)
Sanitation	Open	21	16 (76%)	5 (24%)
	Closed	110	9 (8%)	101 (92%)
Barefoot	Yes	14	14 (100%)	0 (0%)
	No	117	11 (9%)	106 (91%)

Comparison between wet mount and formol ether concentration method

Out of the 517 samples, total of 79 were positive by direct method whereas 81 were detected by the concentration method. Thus an additional 2 samples were detected by the concentration technique. The sensitivity, specificity, positive predictive value and negative predictive values were found to be, 100%, 99.1%, 95.2% and 100%, respectively, considering the direct wet mount as the gold standard.

Discussion

IPIs are still a public health problem in developing countries [9]. Hot humid weather conditions, poverty, illiteracy, contaminated drinking water are few of the causes attributable to the prevalence of these infections [10]. The overall prevalence of intestinal parasites was found to be 15% which is comparable to the study done by Shobha *et al.,* (2013) which calculated the prevalence in Western India to be 15.19% [11]. A much lower prevalence of 3% was seen in a study from Northern India and from the Southern part of the country [12, 13]. In a retrospective analysis done by Praharaj *et al.*, (2017) [14] the prevalence was found to be 8.9%, but the calculated prevalence is higher in studies done outside India, such as Yemen and Africa [15-16]. The differences can be attributed to the different study population, composition and, demographic factors as well as the difference in knowledge, attitude and practices in the population. In this study, the most isolated parasites were the protozoans, which is like the study done by Praharaj *et al.,* (2017) and Al-Yousofi *et al.*, (2022) which showed the prevalence to be 11% and 44.5% respectively [14, 16]. The protozoans are easily transmitted by ingestion of contaminated food and water or by person-to-person transmission [17-18].

The most prevalent protozoan cyst isolated in this study was that of *Giardia lamblia* followed by *Entamoeba histolytica/dispar*. This was similar to the results from the study done by Al-Yousofi *et al.*, (2022) [16] but a study by Singh *et al.,* (2023) [12] showed cyst of *Entamoeba histolytica/dispar* to be most prevalent followed by that of *Giardia sp*. It can also be mentioned here that Amoebic Liver Abscess (ALA) is the most common extra intestinal manifestation of *Entamoeba histolytica* infection [19]. Unlike the protozoans, the Soil Transmitted Helminths (STH) cause infection by penetration of the larval stages that develop outside the human body, though *Ascaris* and *Trichuris* are transmitted through feco-oral route [20]. Among the helminths, *Ascarissp.* was the most prevalent. This finding is similar to that observed by Deka *et al.*, (2022) [21] in malnourished children but, in few studies *Ascaris* was the least prevalent helminth [15-16]. Monoparasitism was prevalent in this study except for 3 samples where biparasitism was seen. This could be attributed to the presence of more than one risk factor or an acute infection on a chronic one.

In this study, though the total number of samples received from urban population was more, the positive findings were more in samples from rural population which were statistically significant showing an attribution of place of residence to the positive findings. This concurs with the study done by Langbang *et al.*, (2019) [22] which also showed a statistically significant association between the place of residence and prevalence of intestinal parasites.

In this study majority of the population had access to proper sanitation facilities but the positive findings were statistically associated ($p < 0.0001$) with open defecation which was done by only 10%

of the population, similar to what Deka *et al*., (2022) observed ($p < 0.028$) [21]. Walking barefoot was also statistically associated with the presence of STH. A similar association was reported by Patil & Pratinidhi (2012) [23]. For urban population open defecation and barefoot walking was not found to be the risk factors suggesting the presence of other modes of transmission.

The most common parasite isolated being *Ascaris*, similar to the finding by Deka *et al*., (2022) which showed similar findings in under-five malnourished children [21]. Most of the positive findings were seen in males, which agrees with the study done Praharaj *et al*., (2017) [14]. In contrast few studies have shown the prevalence in females to be higher [16, 24]. Though there is no correlation with gender, more samples from males compared to females and more outdoor activities carried out by males can be attributed to this finding. Higher prevalence of intestinal parasitosis was seen in the age group ⩽ 20 years and 21-20 years even though none of the stratified age groups showed statistically significant results. Similar results were obtained in the study done by Al-Fakih *et al*., (2022) [15].

Considering the clinical symptoms diarrhoea, abdominal pain, fever and dysentery were statistically associated with the presence of intestinal parasites, diarrhoea being the most common presentation. Similar findings were also reported by Al-Fakih *et al*., (2022) [15]. Not much difference was observed in the sensitivity and specificity of the two methods of examination. In only two samples, the concentration method was useful in detecting the parasites. Single centric and single stool examination are the limitations of the study. Examining three stool samples could have increased the sensitivity.

Conclusion

High (15%) prevalence demonstrates that intestinal parasitosis is still an existing public health problem in some areas. The intestinal protozoans are much more prevalent compared to the STH which might be due to the filarial elimination initiative taken up by the Government. The statistically significant association between barefoot walking, type of residence and sanitation proves these to be the risk factors. Even though it is a hospital-based study, the results of the study can be used in implementation of the prevention policies in the area.

Acknowledgments

The authors would like to express their appreciation to Sharda University, UP, India, for all of the support as well as the technical team of the Microbiology department for their assistance.

References

1. Gholipoor Z, Khazan H, Azargashb E, Youssefi MR, Rostami A. Prevalence and risk factors of intestinal parasite infections in Mazandaran province, North of Iran. *Clin Epidemiol Global Health* 2020;8(1):17-20.
2. World Health Organization. Soil-transmitted helminth infections; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections. Accessed March 17, 2024.
3. Taghipour A, Ghodsian S, Jabbari M, Olfatifar M, Abdoli A, Ghaffarifar F. Global prevalence of intestinal parasitic infections and associated risk factors in pregnant women: a systematic review and meta-analysis. *Trans R Soc Trop Med Hyg* 2021; 115(5):457-470.
4. Pullan RL, Smith JL, Jasrasaria R, Brooker SJ. Global numbers of infection and disease burden of soil transmitted helminth infections in 2010. *Parasit Vectors* 2014; 7:37.
5. Sitotaw B, Mekuriaw H, Damtie D. Prevalence of intestinal parasitic infections and associated risk factors among Jawi primary school children, Jawi town, north-west Ethiopia. *BMC Infect Dis* 2019; 19(1):341.

6. Paniker CKJ. Paniker's Textbook of Medical Parasitology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers; 2018.
7. Das BB, Panda AK, Patra MP, Nayak K, Das BB, Nayak KN. Study on the role of gastrointestinal parasite in irritable bowel syndrome patients in a tribal region of India. *Cureus* 2022;14(6): e26091.
8. Allen AV, Ridley DS. Further observations on the formol-ether concentration technique for faecal parasites. *J Clin Pathol* 1970; 23(6):545-546.
9. Al-Delaimy AK, Al-Mekhlafi HM, Nasr NA, Sady H, Atroosh WM, Nashiry M, *et al*. Epidemiology of intestinal polyparasitism among Orang Asli school children in rural Malaysia. *PLoS Negl Trop Dis* 2014;8(8):e3074.
10. Sadeghi H, Borji H. A survey of intestinal parasites in a population in Qazvin, north of Iran. *Asian Pacific J Trop Dis* 2015;5(3):231-3.
11. Shobha M, Bithika D, Bhavesh S. The prevalence of intestinal parasitic infections in the urban slums of a city in Western India. *J Infect Public Health* 2013; 6(2):142-149.
12. Singh N, Sinha R, Kumar R, Muni S, Saurabh K, Kumari N. Prevalence of intestinal parasitic infections and attributable factors among patients presenting with gastro-intestinal symptoms at a tertiary care center in Northern India: a prospective cohort study. *J Med Sci Clin Res* 2023; 11(10): 132-140.
13. Saraswathi R, Lalithambigai J, Vazhavandal G, Uma A, Prabhusaran N, Velayutharaj A. Prevalence of intestinal parasitic pathogens in stools from medical speciality units of tertiary rural teaching hospital, Tamilnadu, India. *Int J Curr Microbiol App Sci* 2016;5: 429-435.
14. Praharaj I, Sarkar R, Rao Ajjampur SS, Roy S, Kang G. Temporal trends of intestinal parasites in patients attending a tertiary care hospital in south India: A seven-year retrospective analysis. *Indian J Med Res* 2017;146(1):111-120.
15. Al-Fakih AA, Al-Wrafi EA, Al-motawkil AA, Shabalah AZ, Aqeel AF, Mahdi MA, *et al*. Prevalence of intestinal parasitic infections and associated risk factors among schoolchildren in Ibb Governorate, Southwest Yemen: A cross-sectional study. *Pediatr Health Med Thera* 2022; 13:325-333.
16. Al-Yousofi A, Yan Y, Al_Mekhlafi AM, Hezam K, Abouelnazar FA, Al-Rateb B, *et al*. Prevalence of intestinal parasites among immunocompromised patients, children, and adults in Sana'a, Yemen. *J Trop Med* 2022;2022: 5976640.
17. Leung AKC, Leung AAM, Wong AHC, Sergi CM, Kam JKM. Giardiasis: An Overview. *Recent Pat Inflamm Allergy Drug Discov* 2019; 13(2):134-143.
18. Kantor M, Abrantes A, Estevez A, Schiller A, Torrent J, Gascon J, *et al*. Entamoeba histolytica: updates in clinical manifestation, pathogenesis, and vaccine development. *Can J Gastroenterol Hepatol* 2018;2018: 4601420.
19. Patel H, Patil VC, Kulkarni A, Bhoite A. Amoebic Liver Abscess in Newly Detected HIV Infection. *J Krishna Inst Med Sci Univ* 2019; 8(1):90-94.
20. Parija SC, Chidambaram M, Mandal J. Epidemiology and clinical features of soil-transmitted helminths. *Trop Parasitol* 2017; 7(2):81-85.
21. Deka S, Kalita D, Hazarika NK. Prevalence and risk factors of intestinal parasitic infection in under-five children with malnutrition: a hospital based cross-sectional study. *J Family Med Primary Care* 2022; 11(6):2794.
22. Langbang D, Dhodapkar R, Parija SC, Premarajan KC, Rajkumari N. Prevalence of intestinal parasites among rural and urban population in Puducherry, South India-A community-based study. *J Family Med Primary Care* 2019;8(5):1607.
23. Patil M, Pratinidhi SA. Disseminated tuberculosis with *Strongyloidesstercoralis* infestation. *J Krishna Inst Med Sci Univ* 2012; 1(1): 107-112.
24. Messaad SA, Laboudi M, Moumni M, Sarhane B, Belghyti D, El Karrim KH. Children Intestinal parasites related to socio-economic factors in Salé Hospital, Morocco. *Int J Innova Appl Stud* 2014;8(2):833.

***Author for Correspondence:**
Dr. Zarine Khan, Department of Microbiology, School of Medical Sciences and Research, Sharda Hospital, Greater Noida-201306, Uttar Pradesh
Email: zarine.khan@sharda.ac.in Cell: 9716035053

How to cite this article:
Khan Z, Sarwat T, Srivastava R, Kakru DK. Prevalence and risk factors of intestinal parasitic infections in a tertiary care teaching hospital. *J Krishna Inst Med Sci Univ* 2024; 13(2):90-97.

***Submitted:** 30-Dec-2023* ***Accepted:** 28-Feb-2024* ***Published:** 01-Apr-2024*